

11-16-00

IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

David Lahiri Bhatoolaul
Qiang Cao
Patrick Charriere
Seau Sian Lim

CASE 10-23-2-9

TITLE Data Packets For Mobile Telecommunications Systems

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

NEW APPLICATION UNDER 37 CFR § 1.53(b)

Enclosed are the following papers relating to the above-named application for patent:

Specification
4 Formal Sheets of drawing(s)
Information Disclosure Statement
Certified Copy of European Patent Application

CLAIMS AS FILED				
	NO. FILED	NO. EXTRA	RATE	CALCULATIONS
Total Claims	15 - 20 =	0	x \$18 =	\$0
Independent Claims	3 - 3 =	0	x \$80 =	\$0
Multiple Dependent Claims, if applicable			+ \$270 =	\$0
Basic Fee				\$710
			TOTAL FEE	\$710

Please file the application and charge **Lucent Technologies Deposit Account No. 12-2325** the amount of \$710, to cover the filing fee. Duplicate copies of this letter are enclosed. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 12-2325** as required to correct the error.

The Assistant Commissioner for Patents is hereby authorized to treat any concurrent or future reply, requiring a petition for extension of time under 37 CFR § 1.136 for its timely submission, as incorporating a petition for extension of time for the appropriate length of time if not submitted with the reply.

Please address all correspondence to **Docket Administrator (Room 3C-512), Lucent Technologies Inc., 600 Mountain Avenue, P.O. Box 636, Murray Hill, New Jersey 07974-0636**. However, telephone calls should be made to me at (973) 386-2992.

Respectfully,

Christopher N. Malvone
Christopher N. Malvone
Reg. No. 34866
Attorney for Applicant(s)

Date: November 15, 2000
Lucent Technologies Inc.
600 Mountain Avenue (Room 3C-512)
P.O. Box 636
Murray Hill, New Jersey 07974-0636

"Express Mail" mailing label
number: EK908722803
Date of Deposit 11/15/00
I hereby certify that this Application
being deposited with the United States Postal
Service "Express Mail Post Office to
Addressee" service under 37 CFR 1.10 on the
date indicated above and is addressed to the
Commissioner of Patents and Trademarks
Washington, D.C. 20231.
RLS F. THOMAS
(Printed name of person mailing paper or fee)
RLS F. Thomas
(Signature of person mailing paper or fee)

11/15/00
U.S. PTO
09/113129

Data Packets for Mobile Telecommunications Systems

Background of the Invention

1. Field of the Invention

5 The present invention relates to mobile telecommunications systems, particularly though not exclusively the Universal Mobile Telecommunications System (UMTS).

2. Description of the Related Art

10 In systems such as UMTS and GSM, data is transmitted over the air interface as packets, and the length of the payload transported by a packet is indicated by the Length Indicator (LI) field contained in its header. In systems such as GSM, the LI values are defined in octets. In the UMTS system, the packets have a strictly defined structure and are known as Data Units, e.g. Protocol Data Units (PDU). Their format is defined in the 3GPP™ RLC Protocol Specification 3G TS 35.322, Section 9.2 – Elements for Peer-to-Peer Communication – Formats and Parameters. Generally these Data Units have a
15 header and one or more following payload units of data. Many of these Data Units have length indicator (LI) fields, e.g. UMD PDU and AMD PDU (unacknowledged/acknowledged mode data PDU). In UMTS, the length indicator (LI) gives the number of octets of the length of a data segment. The size of the length indicator may be either 7 or 15 bits. If more than one payload unit (PU) is transported in the packet additional length
20 indicators can be used to indicate the limit between the different PU's. The length Indicator Field is also used to indicate the start of the padding area at the end of a packet.

 With UMTS, some applications (e.g. Adaptive Multi Rate speech codecs) produce frames whose length is not a multiple value of 8 bits. Therefore, with such frames, there is no way to indicate to the peer-receiving end the exact length of the payload.

Summary of the Invention

25 The present invention adapts the length indicator field so that it can indicate the precise length of a payload unit, even where the length is not a multiple value of 8 bits. Whilst it would in principle be possible to have the length indicator field increased in granularity to indicate the payload in number of bits, this would result in a need for a
30 longer LI field (3 more bits needed). On the other hand, many applications do not require a decrease in LI granularity, since the data is always defined in octets. Thus in the general

case decreasing the LI granularity leads to a waste of bandwidth.

Thus, the present invention creates, for a payload of a packet, a length indicator field of variable granularity, depending on the exact length of the payload to be transmitted. An additional field is provided, which may just be a single bit in length, to indicate the granularity of the length indicator field.

Thus a first embodiment of the present invention provides, in a mobile telecommunications system, a method of indicating the length of a data payload to be transported in a packet, the method comprising:

- a. assessing the length of a data section to determine the appropriate units, from a plurality of possible units, in which the length should be expressed;
- b. setting a granularity field to define said appropriate units in which the length of the data is to be indicated in a data length indicator field; and
- c. setting the length indicator field to indicate the data length.

In a second embodiment, the present invention provides, in a mobile telecommunications system, apparatus for providing an indication of the length of a data payload to be transported in a packet, the apparatus comprising:

- a. means for assessing said length of data to determine appropriate units, from a plurality of possible units, in which the length should be expressed;
- b. means for setting a granularity field to define said appropriate units in which the length of the data is to be indicated in a data length indicator field; and
- c. means for setting the length indicator field to indicate the data length.

In a third embodiment, the present aspect, the present invention provides in a mobile telecommunications system, an indicator of the length of data to be transported in a packet, wherein the packet comprises:

a granularity field in the packet header which defines the units in which the length of the data is to be indicated; and

a length indicator field indicating the packet data length in the units defined by the granularity field.

As preferred the granularity field may be a single bit to indicate whether the length indicator field is expressed in bits or octets. However the granularity field may be more than one bit to indicate other units, for example kilo-octets; in principle any units

may be used, e.g. hexadecimal.

Thus, the solution is to create in the packet header an indicator for the LI granularity of the field. For instance one bit can be used to indicate if the LI fields are in octets or in bits. This bit is dynamically changed, preferably on a packet per packet basis.

5 Since the LI field granularity is managed on a packet by packet basis, it optimizes the transmission bandwidth and meets whenever needed the requirements to transmit PDU's with non-multiple of 8 bits payload sizes.

Brief Description of the Drawings

10 A preferred embodiment of the invention will now be described with reference to the accompanying drawings, wherein

Figures 1 and 2 are schematic diagrams of protocol data units (PDU) for the UMTS incorporating the of the present invention;

Figure 3 is a flow chart showing the method of the present invention for inserting a granularity field into a PDU: and

15 Figure 4 is a schematic block diagram of apparatus for carrying out the method of Figure 3.

Description of the Preferred Embodiment

Referring now to Figures 1 and 2, there is shown two UMTS PDU of similar type, for example AMD PDU. The PDU of Figure 1 has a header 10. The header 10 comprises
20 various fields formed in Octets of bits, with Octet 2 having a first bit reserved as a Granularity Indicator 14, for the next subsequent field in Octet 3, a Length Indicator 16. Length Indicator 16 indicates the length of the data octets, or payload, 18 attached to the header. In addition a further padding 20 of (k-n) octets is provided. In this example payload 18 is not an even number of octets, but has some remainder bits. Accordingly
25 the Granularity Indicator 14 is set to Gr=1, and the Length Indicator 16 is expressed as a number of bits L1. This may require Indicator 16 being more than one octet.

In Figure 2, similar parts are indicated by the same reference numerals. A payload 22 has an even number of octets, L1'. In addition a padding 24 has an even number of octets. In this example the Granularity Indicator 14 is set to Gr=0, and the Length
30 Indicator 16 is expressed as a number of octets L1'.

Referring to Figure 3, the method of the invention is carried out as follows. From a start point 30, which is initiated when PDU are to be transported, each consecutive PDU is assessed at 32 to determine whether the size of the first payload unit is an integral multiple value of 8 bits. Since some PDU may contain more than one payload, an assessment is made at 34 whether this is the last payload unit. If not, the next payload unit is considered at 36.

If at 32 the payload is not an integral multiple value of 8 bits, the Granularity Indicator is set at 36 $Gr=1$, and at 38 the Length Indicator is expressed as a number of bits. If at 32 the payload is an integral multiple value of 8 bits, and the payload is the last payload unit, the Granularity Indicator is set at 40 $Gr=0$, and at 42 the Length Indicator is expressed as a number of octets. Thus in order for $Gr=0$, all the payload units in the packet must be octets. However for $Gr=1$, only one payload unit need be not an integral multiple value of 8 bits.

Finally, at 44, the method is paused to await information of the next PDU to be transported.

Referring now to Figure 4, this shows apparatus for carrying out the method of Figure 3, comprising an information receiver unit 50 for receiving information as to the next available packet. When available, this information is passes to a size assessor unit 52, which determines whether each payload unit of the packet is or is not an integral multiple value of 8 bits. A feedback loop 54 indicates that each payload unit is considered in sequence. Assessor unit 52 is coupled to a Granularity field unit 56 for setting the Granularity Indicator, and this is in turn coupled to a Length Indicator Unit 58 for indicating the length of the payload.

CLAIMS

1 1. In a mobile telecommunications system, a method of indicating the length of a
2 data payload to be transported in a packet, the method comprising:

3 a. assessing (32, 34) the length of a data section to determine the appropriate
4 units, from a plurality of possible units, in which the length should be expressed;

5 b. setting (36, 40) a granularity field to define said appropriate units in which
6 the length of the data section is to be indicated in a data length indicator field; and

7 c. setting (38, 42) the length indicator field to indicate the data length.

1 2. A method according to claim 1, wherein the appropriate units are determined to
2 be the largest units in which the length can precisely be expressed.

1 3. A method according to claim 1, wherein the units are bits and octets, and the
2 granularity field is one bit in length to indicate length in bits or octets.

1 4. A method according claim 1, wherein the granularity field is located in the
2 packet header adjacent the length indicator field.

1 5. A method according claim 1, wherein a packet is assessed (36) to determine
2 whether it contains more than one payload unit, and each payload unit is assessed to
3 determine said appropriate units.

1 6. A method according to claim 5, wherein the granularity field is set according to
2 the units of the payload unit which is be expressed in the smallest units

1 7. A method according to claim 6, wherein the granularity field is set according to
2 larger units of the possible units, if all the payload units can be expressed in such larger
3 units.

1 8. In a mobile telecommunications system, apparatus for providing an indication
2 of the length of a data payload to be transported in a packet, the apparatus comprising:

3 a. means (52) for assessing said length of data to determine appropriate units,
4 from a plurality of possible units, in which the length should be expressed;

5 b. means (56) for setting a granularity field to define said appropriate units in
6 which said length of data is to be indicated in a data length indicator field; and

7 c. means (58) for setting the length indicator field to indicate the data length.

1 9. Apparatus according to claim 8, wherein the assessing means is arranged to
2 determine the appropriate units as the largest units in which the length can precisely be
3 expressed.

1 10. Apparatus according to claim 8, wherein the assessing means is operative to
2 determine whether a packet contains more than one payload unit, and for assessing each
3 such payload unit to determine said appropriate units.

1 11. Apparatus according to claim 10, operative to select the appropriate units
2 according to the units of the payload unit which is to be expressed in the smallest units

1 12. Apparatus according to claim 10, operative to select larger units of the
2 possible units, if all the payload units can be expressed in such larger units.

1 13. In a mobile telecommunications system, an indicator of the length of data to
2 be transported in a packet, wherein the packet comprises:

3 a granularity field (14) in the packet header (10) which defines the units in which
4 the length of the data is to be indicated; and

5 a length indicator field (16) indicating the packet data length in the units defined
6 by the granularity field.

1 14. A packet according to claim 13 wherein the granularity field is one bit in
2 length to indicate length in bits or octets.

1 15. A packet according to claim 13, wherein the granularity field is located in the
2 packet header adjacent the length indicator field.

ABSTRACT

In a data packet, e.g. a PDU of the UMTS, a length indicator field (16) of variable granularity is created, depending on the exact length of the payload to be transmitted. An additional field (14) is provided, a single bit in length, to indicate the granularity of the length indicator field. This increases the resolution of the header, whilst keeping low an overhead of extra field bits. The method of the invention comprises:

- a. assessing (32, 34) the length of the data to determine the appropriate units, from a plurality of possible units, in which the length should be expressed;
- b. setting (36, 40) a granularity field to define said appropriate units in which the length of the data is to be indicated; and
- c. setting (38, 42) the length indicator field to indicate the data length.

1/4

FIG. 1

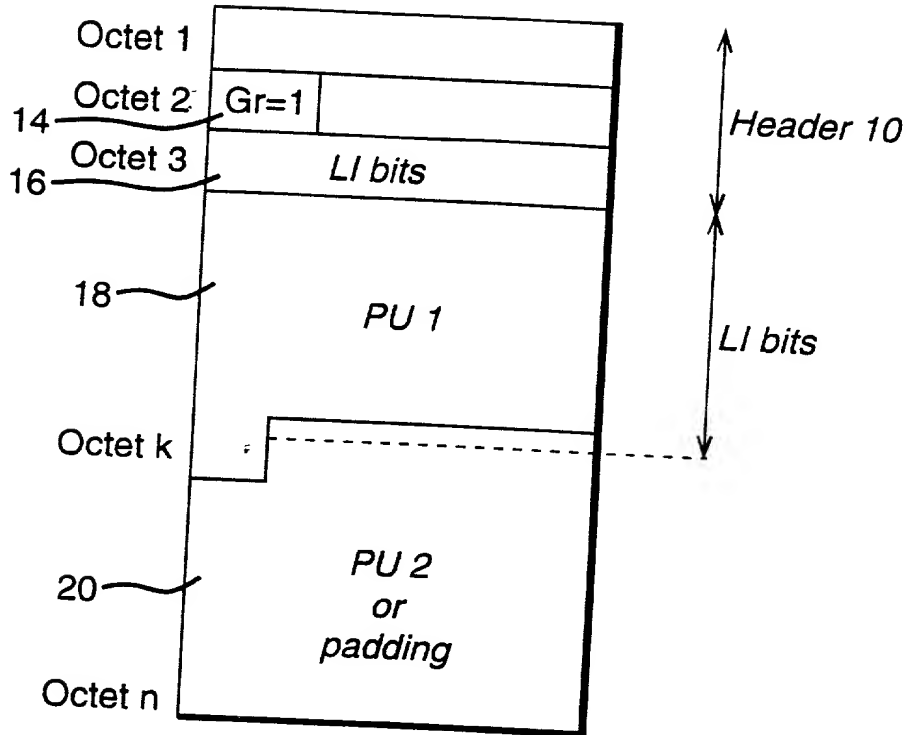


FIG. 2

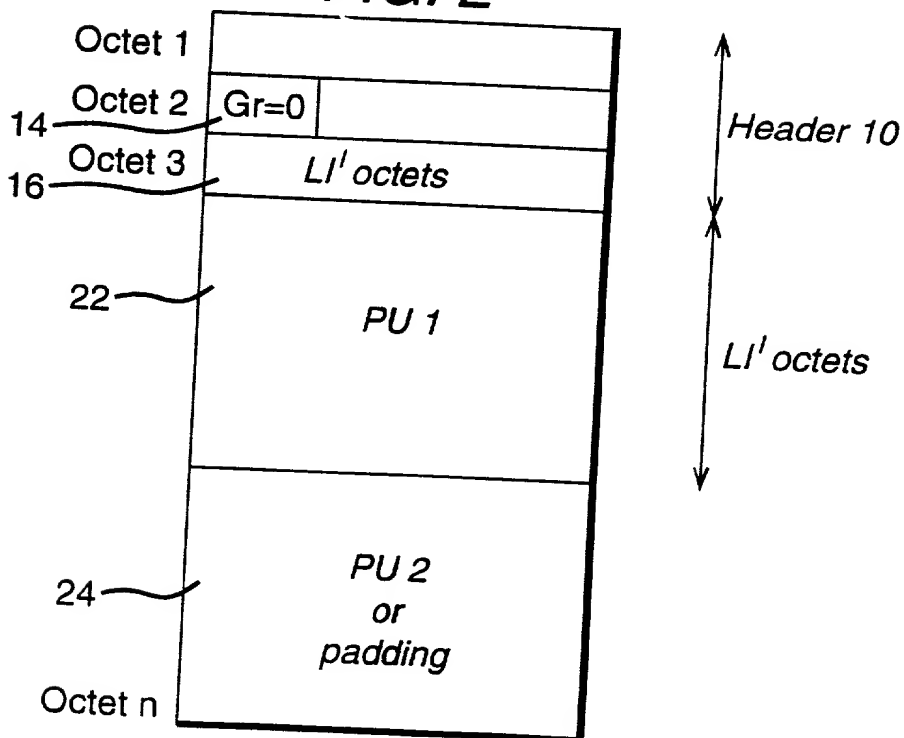
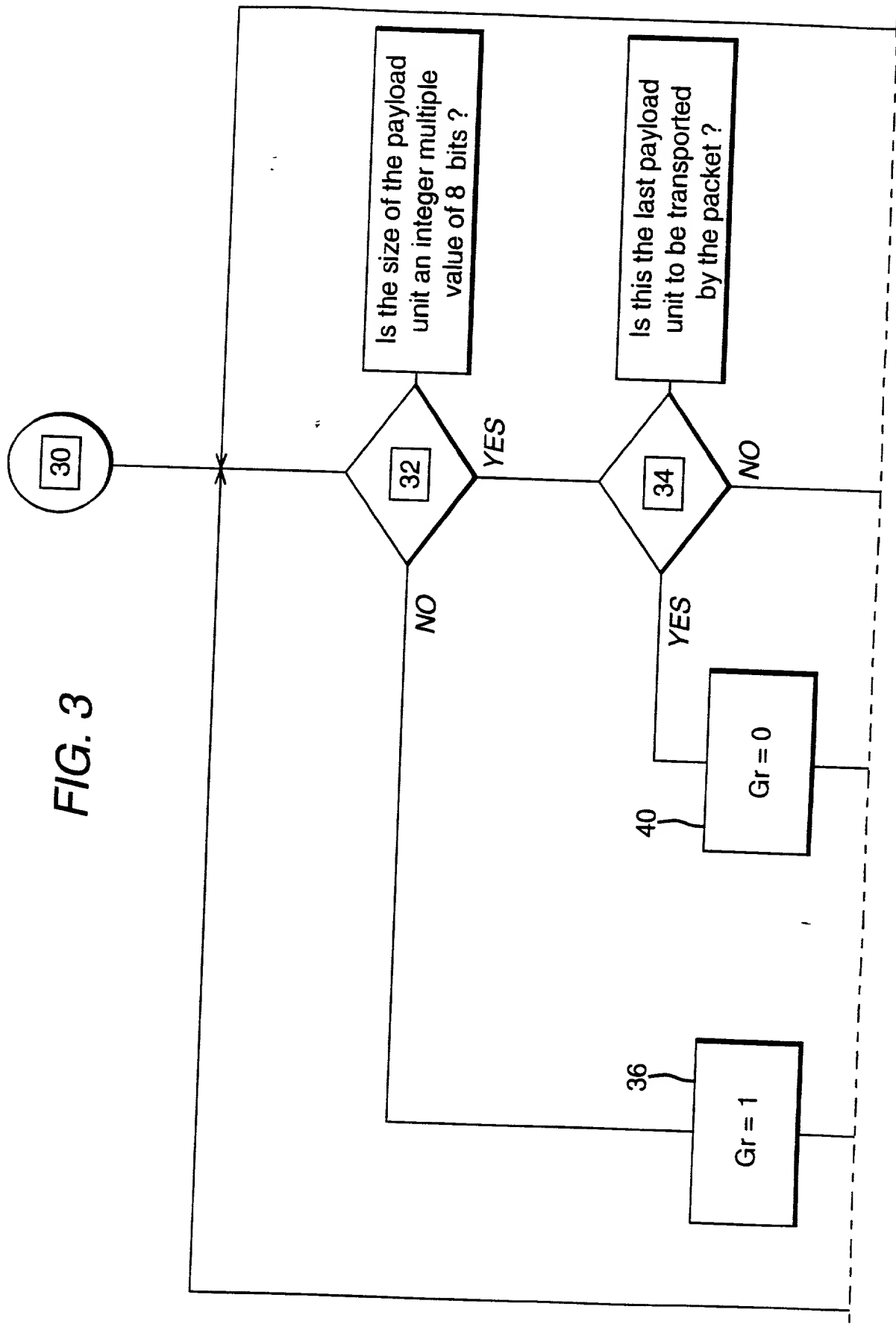


FIG. 3



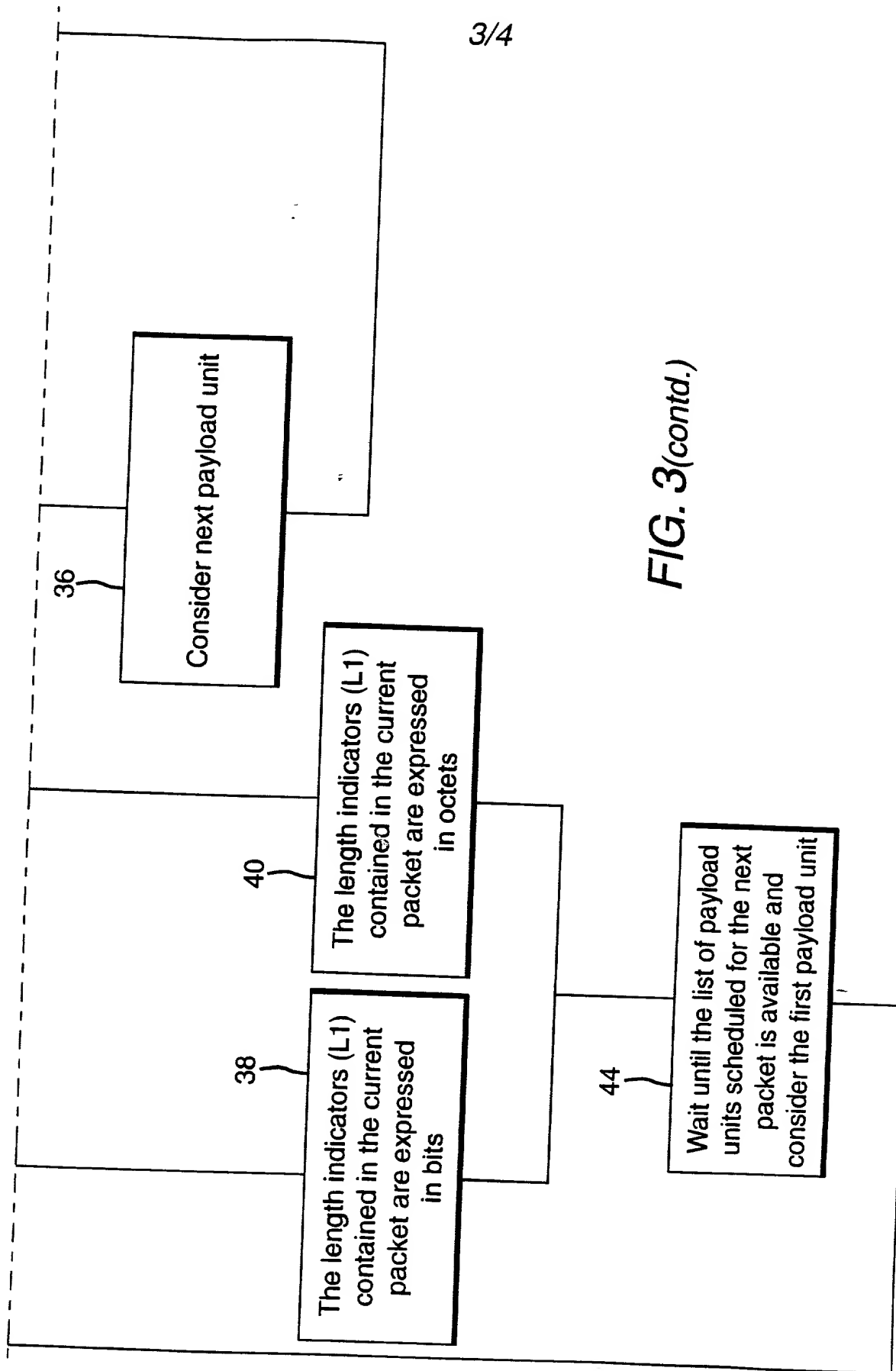


FIG. 3(contd.)

FIG. 4

